



1571 S. Suncliff, Unit K
Anaheim, CA 92806
714/939-6357
Fax 714/939-6359

ELECTRONIC CHROME

CHROME PRECIPITATION AND EVAPORATION SYSTEM

OPERATION

and

MAINTENANCE MANUAL



October 1991

Principles of Operation

The concentrated waste from the Acid Strip Tank is collected in the Waste Storage Tank. This waste is predominantly acidified Tri-Chrome. Any waste from inside the shop shall be predominantly acidified Hex-Chrome. This should also be collected in the Waste Storage Tank. Mixing the two, Tri-Chrome and Hex-Chrome will aid in breaking up any Dichromate complexes.

This collected waste solution is then "metered" into the T-3 Neutralization Tank at a nominal .25 GPM (appx. 120 gallons per day on an 8 hour day). In T-3 Magnesium Hydroxide is added, automatically controlled by the Kruger & Eckels pH Controller. This adjusts the pH and starts the precipitation process. This Controller is set for a pH of 6.0. Since the Mag Hydroxide is a very slow reacting material, you'll notice "spikes" up to 8 and 8.5 due to the "reaction time vs. the flow" through the tank. This is perfectly acceptable and has been allowed for in the System set-up.

The solution then gravity flows into the T-4 Neutralization Tank. Here Sodium Hydroxide and Sodium Hydrosulfite are added, again automatically controlled by a Kruger & Eckels pH Controller (for the Sodium Hydroxide) and a Kruger & Eckels ORP Controller (for the Sodium Hydrosulfite). The Sodium Hydrosulfite is available to reduce any Hex-Chrome to the Tri state. This controller is set for +70 Mv. Readings above +70 Mv. denote the presence of Hex-Chrome and regulate the chemical additions. The Sodium Hydroxide is set for a pH of 8.0 to 8.5. This is the optimum pH for precipitation of the Heavy Metals in solution. The availability of this chemical addition is only in case the Mag Hydroxide does not respond fast enough to reach this pH prior to the solution flowing to the Polymer stages.

The next two stages are the Polymer Flash Mix Tank and the Polymer Flocculation Tank. In the Polymer Flash Mix, Anionic Polymer is added to build up the particle size for effective settling. This stage has an Air Sparger for mixing of the Polymer throughout the entire solution. This agitation should be "Moderate" to "Mild" for effective mixing. In the Polymer Flocculation Tank, the continued agitation allows for complete contact of the Heavy Metal particles with the Polymer allowing the building of the largest possible particle size. Again, there is an Air

Sparger for mixing. The agitation in this tank must be "Mild". Excessive agitation will break the particles into smaller sizes and reduce the effectivity of the Clarifier.

After Polymerization and Flocculation, the solution flows through the Two Stage Clarifier. Here the large Heavy Metal particles are allowed to gravity settle into the cone bottoms. The clarified liquid then flows through the Clarifier Weir Drain and is returned to the Recycle Tank. Clarified solution in the Recycle Tank is then pumped back to the T-3 Neutralization Tank for dilution of the concentrated waste solution.

Sludge build-up in the cone bottoms of the Clarifier is then pumped through the Filter Press for dewatering and solidification. The dried sludge from the filter press may be disposed of to a Solid Waste Disposal Station or sent out for reclamation of the Chrome. Filtrate from the filter press is returned to the first stage of the Clarifier.

The Evaporator has two functions. First is to evaporate the excess clarified solution that is added to the System from the concentrated waste and reagent chemicals. The second function is to Evaporate clarified solution to reduce the "Salt" build up from the treatment process. This unit is equipped with an automatic liquid level controlled "Fill Pump". This pump automatically draws solution from stage one of the Clarifier when the liquid level reaches approximately 6" above the heater tubes and then shuts-off at approximately 6" below the top of the tank. As concentrated "Salt" solution is built up in the bottom of the Evaporator, periodically this solution should be processed through the filter press to strip the solids.

Start-up and Operation
of the Chrome Precipitation System

The System has been initially set-up and adjusted to achieve the proper waste concentrate dilution flow rates and chemical additions. The two most important set-ups are the Recycle Pump and the Waste Solution Metering Pump. The recycle pump is a Wilden Model M-2 Diaphragm Pump and should be adjusted to a nominal 100 to 110 strokes per minute. At a displacement of .1 gallons per stroke, this equates to the required 10 GPM recirculation rate. The Waste Solution Metering Pump is a LMI Model D-141-34 with a capacity of 20 GPH. This pump should be set at a Stroke and Speed of 70 to achieve the desired .25 GPM.

The Mag Hydroxide Recycle Pump is also a Wilden Model M-2 Diaphragm Pump and should be adjusted to a nominal 50 to 60 strokes per minute. At displacement of .1 gallons per stroke, this equates to a 5 GPM recirculation rate.

The Sodium Hydrosulfite Pump, the Sodium Hydroxide Pump, and the Polymer Pump are all LMI Model B-131-71T and B-131-74 Metering Pumps. These three pumps need to be adjusted to achieve the optimum the reaction of their respective chemical reagents.

When starting the system be sure the Main Air Valve, all Individual Air Valves, the Water Valve, the Mag Storage Tank Shut-off Valve, and all of the Flow Piping Valves are open. Initial start-up consists of the following steps:

1. Turn on the Control Power Switch. This shall light up the Control Power Available Light.
2. Turn on the Power and Set Point Power Toggle Switches on each of the three Kruger and Eckels Controllers. The Set Point Power Toggle Switches shall automatically operate the Sodium Hydroxide and Sodium Sulfite Metering Pumps and the Gemu Mag Injection Valve in response to the Set Point settings on the Controllers.
3. Turn the Mag (OH)₂ Mixer 3 Switch to Auto. This will cycle the mixer on for approximately five minutes of each hour to prevent over mixing and thickening of the Mag Hydroxide solution. When the mixer is in operation the Mag(OH)₂ Mixer in Operation Light shall come on.

If the System has been off for more than One Day (24

hours), turn the Mag (OH)₂ Mixer 3 Switch to On for at least five minutes. This will agitate settled Mag Hydroxide in the Mag Storage Tank preventing clogging of the Mag Recirculating Pump. After five minutes set the Mag (OH)₂ Mixer 3 Switch to Auto.

4. Turn on the Mag (OH)₂ Recirculation Pump Switch. This shall light up the Mag (OH)₂ Recirculation Pump P3 in Operation Light and start the Mag Hydroxide recirculating.
5. Turn on the Neutralization Mixer in T4 and T3 Switches. Their respective In Operation Lights shall light up and the mixers shall start agitation of the Neutralization tanks.
6. Turn on the Flow Control System Switch. The Flow Control System Activated Light shall illuminate and the M-2 Recycle Pump, the Waste Solution Metering Pump, and the Polymer Metering shall all activate. Since these three Pumps are all on a common operation switch, should individual On/Off control be required, each individual unit has its own circuit breaker inside the Control Cabinet.

Shut down of the System down consists of the following steps:

1. Turn off the Flow Control System Switch.
2. Turn the Mag (OH)₂ Recirculation Pump Switch to Off/Flush. Allow at least five minutes for the automatic water flush to complete its cycle.

This procedure is very important. If the Mag Recirculating Pump and piping are not properly flushed, it could result in Mag Hydroxide settling in the pump and/or piping and clogging the recirculation function.

3. Turn off the Mag (OH)₂ Mixer 3 Switch and Neutralization Mixer in T4 and T3 Switches.
4. After the five minutes delay for Mag (OH)₂ Recirculation Pump Off/Flush cycle, the turn off the Control Power. This shall automatically turn off the Kruger & Eckels Controllers and the respective Metering Pumps.

5. Close the Main Air Valve, all Individual Air Valves, the Water Valve, the Mag Storage Tank Shut-off Valve, and all of the Flow Piping Valves.

Operation of the Evaporator

The Evaporator functions based upon the heating the solution to boiling, and atmospheric discharge of the steam with a blower. The unit is equipped with an air sparger to accelerate the evaporation process. The unit has an evaporation capacity of 120 to 150 gallons per day (8 hours). The Evaporator draws solution from Stage 1 of the Clarifier and should be operated simultaneously with the Chrome Precipitation System to prevent overflowing of the Recycle Tank. The Fill Pump is a Wilden Model M-1 Diaphragm Pump and should be adjusted to approximately 50 to 60 strokes per minute. At a displacement of .018 gallons per stroke this equates to an approximate 1 GPM fill rate.

Additional operation of the Evaporator while the Chrome Precipitation System is off is recommended to reduce the "Salt" build-up in the recycled solution. A mechanical Float Valve, connected to a fresh water supply, will add clean make-up water to the Recycle Tank as required.

When operating the Evaporator while the Chrome Precipitation System is off, be sure not to draw the liquid level in the Clarifier below the pick-up pipe for the Fill Pump. This could result in a Low Level Condition in the Evaporator. Also, do not allow the sludge to build up in the Clarifier to a level where sludge is picked up by the Fill Pump and transferred into the Evaporator.

To initially load Evaporator be sure to open the flow valves on the Wilden M-1 Fill Pump and open the shut-off valves on the air supply pipe. Start-up consists of the following steps:

1. Turn on the Control Power Switch.
2. Program the D15D Temperature Controller to 212° F (refer to enclosed DM15D Instruction Manual).
3. Turn on the Air Solenoid Switch. Note, this unit has an Internal Safety Interlock function that prevents the

Heaters from being activated when this switch is Off. This helps prevent over heating and damage to the heater elements.

4. Turn on the Blower Switch.
5. Turn on the Heater 1 and Heater 2 Switches, and press the Start 1 and Start 2 Push Button Switches. Note, this unit is equipped with an Internal Liquid Level Control function that both cycles the Automatic Fill process and shuts off the Heaters in case of a Low Level Condition. Should a low level condition occur, the Low Level Warning Lights on the Control Panel shall illuminate. The Heaters can not be reactivated until the low level condition has been corrected, and the Start Push Button Switches are pressed.

Shut-down of the Evaporator consists of the reverse of the Start-up procedure, with the exception of programming the DM15D Temperature Controller.

An additional safety function which is built in to the Heaters/Heating System consists of a Protector II Circuit which monitors the temperature of the Heater Tubes. In the event of an Over Temperature Condition, the P-II Circuit will shut off the heaters and sound an alarm. This condition is normally the result of a Low Liquid Level Condition. Once the condition has been corrected and the Heater Tubes have cooled down, the Heaters may be reactivated by pressing the Start 1 and Start 2 Push Button Switches.

After several Fill Cycles have been evaporated, a thick "Salt" laden solution shall collect in the sloped bottom of the Evaporator Tank. When the liquid level in the Evaporator has Almost reached the Fill Cycle Level, this solution should be processed through the Filter Press through the use of the Evaporator Bottom Drain Valve. When draining the Evaporator through the Filter Press, be sure to follow the following procedures:

1. Process solution from the Evaporator through the Filter Press after a load of sludge from the Clarifier has been started. A partially loaded Filter Press is much more effective at stripping the Salts from the Evaporator solution than a clean one.
2. Allow the solution in the Evaporator to Cool Off to

Ambient prior to opening the Bottom Drain Valve.
Failure to cool the solution can result in damage to both the piping and the Filter Press.

3. Be sure the Bottom Drain Valves on the Clarifier are Closed. Failure to Close these Valves can cause the solution to equalize between the Evaporator and the Clarifier causing the Evaporator to overflow.

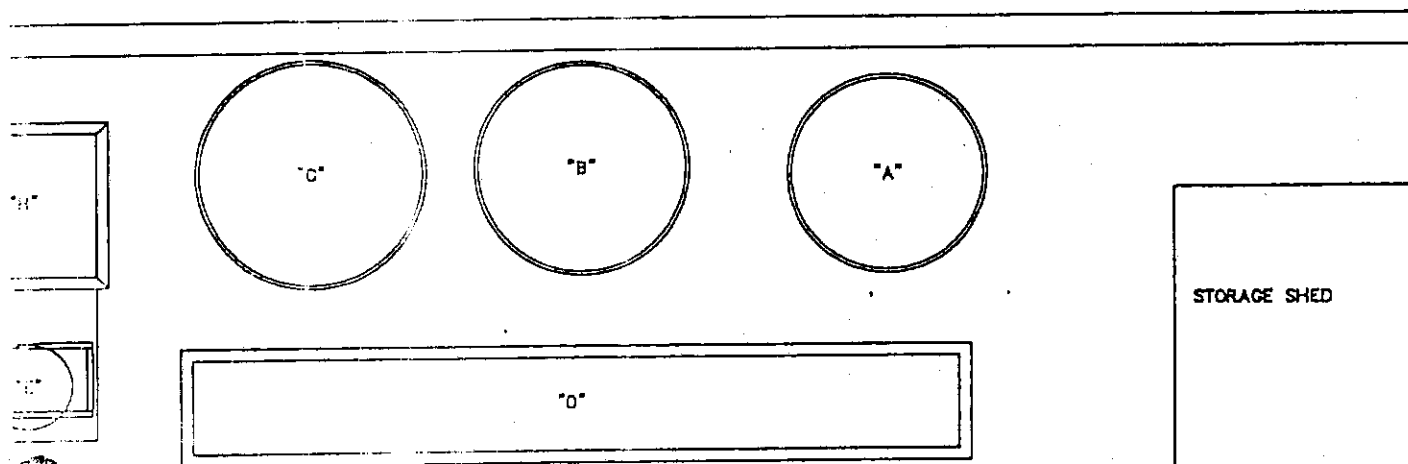
Chemical Make-up and Maintenance

Reagent chemicals and their make-up are as follows:

1. Mag 50 Magnesium Hydroxide Liquid (as shipped by Hill Bros. Chemical in bulk).
2. Sodium Hydrosulfite Powder - Mix 1/2 Lb. of the powder per Gallon of Water.
3. Sodium Hydroxide 50% Liquid (as shipped by the chemical supplier).
4. Aqua Ben 445L Anionic Polymer Liquid - Mix 1 Gallon of Polymer per 5 Gallons of Water.

Maintenance should consist of the following procedures:

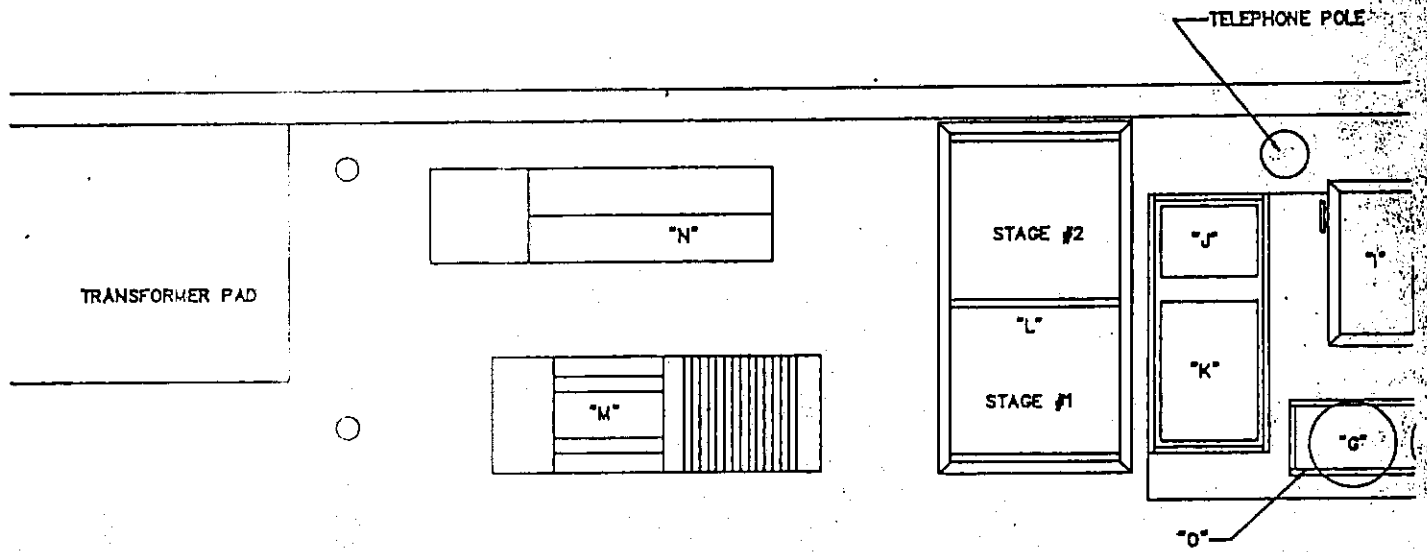
1. Keep the Air Line Lubricators on the Chrome Precipitation System and the Filter Press filled with a Non-Detergent 10W Hydraulic Oil.
2. Clean the Air Line Filters weekly. Do not allow the Compressed Air to build up a water content which will get past the Air Line Filters and into the System Air Line Piping. Should this situation occur, and Air Line Dryer should be installed on the main air line to the System.
3. Lubricate the Gear Reduced Mixers according to the manufacturer recommendation (see enclosed Mix Mor Mixer Service Manuals).
4. Clean and Calibrate the Kruger & Eckels Controller Electrodes at least Quarterly (refer to the enclosed Model 438 Controller Instruction Manuals).
5. For detailed operating and maintenance of the Filter Press, refer to the enclosed Cal Press MC 25 Manual.



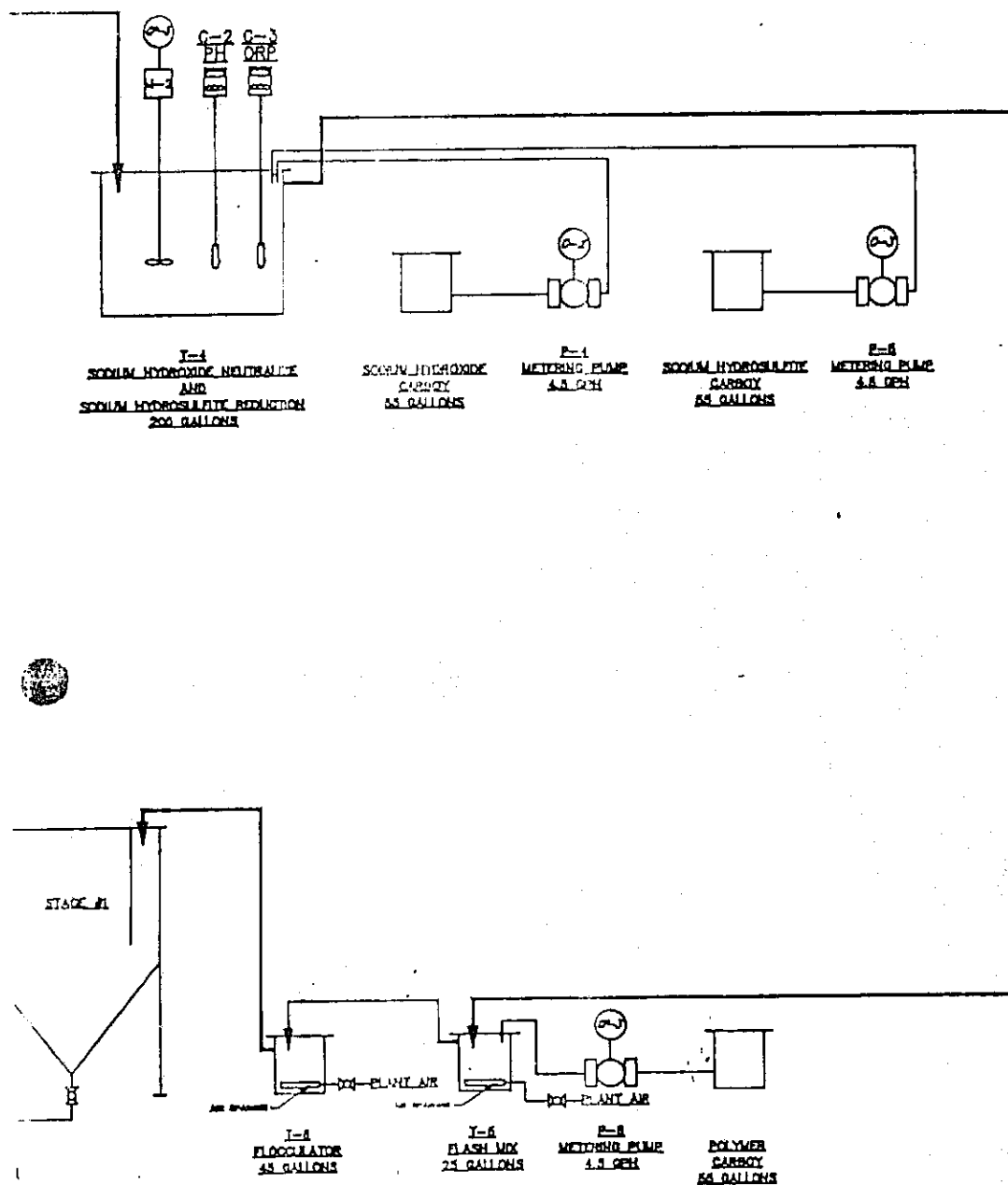
NOTES:

- "A" HCL STORAGE (EXISTING)
- "B" WASTE HOLD (500 GALLONS)
- "C" MAG HYDROXIDE STORAGE (750 GALLON)
- "D" CHROME STRIPPER TANK (EXISTING)
- "E" CAUSTIC DRUM (55 GALLON)
- "F" SODIUM HYDROSULFITE DRUM (55 GALLON)
- "G" POLYMER DRUM (55 GALLONS)
- "H" MAG HYDROXIDE NEUTRALIZE
- "I" CAUSTIC & SODIUM HYDROSULFITE
- "J" POLYMER FLASH MIX
- "K" FLOCCULATOR
- "L" CLARIFIER
 - CL-3, STAGE #1, 500 GALLON
 - CL-4, STAGE #2, 500 GALLON
- "M" 3 CUBIC FOOT FILTER PRESS
- "N" SAMSCO 15 GPH
- "O" CONTROL CENTER

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